Stackable Instructionally-embedded Portable Science (SIPS) Assessments Project

Grade 8 Science

Unit 3 Instructionally-embedded Assessment Task Specification Tool:

"Environmental and Physical Factors Impact Traits in Populations"

Understanding Earth History and the Origin of Species

July 2023

Grade 8	Unit 3	Instructional Segment 4	Task Title: Environmental and Physical Factors Impact Traits in Populations

Unit 3: Understanding Earth History and the Origin of Species

Anchor Phenomenon	Problematization/Investigative Strategy for the Unit
In this unit, the anchoring phenomenon is based on the shared experience the class will have of selecting from an online database of fossils found in their area (https://paleobiodb.org/navigator/). Students select a particular organism to think about throughout the unit by zooming into a region/state of interest on the map and selecting an interesting organism. The teacher can problematize this for students by setting up the general questions, "What do you notice about these organisms? What do you wonder about them?" Details for this anchor phenomenon activity appear in *Fossils Around Us* in Segment 1.	If we want to understand our organism of choice, we need to research its origin through fossil records. We need to understand why some of the species are now extinct from the variation in the current species and fossil records. What was it about their environment that caused them to change? What might have enabled them to survive better than other organisms? We would also need to investigate the expression of genes within the organism. Were there possible mutations that might have occurred that enhanced their survival?

Segment 4 Overview

By engaging in the practices of analyzing and interpreting data, developing and using models, and use of mathematical and computational thinking, students learn about the role of the environment in changing the proportion of a species across a generation and how its survival depends on an advantageous trait. At the end of the segment, students add to their explanatory model to show the role of adaptation as seen in an advantageous trait that was necessary for the survival of their species to which their fossil belonged across many generations.

Assessments for this segment focus on students' ability to develop and use models, analyze and interpret data, construct explanations, and use mathematical representations and models to examine changes in a population over time. Students represent and describe patterns in changes to the presence of traits in a population over time. Students provide explanations for how environmental conditions can cause change and use models to support this explanation. Finally, students explain how the environment caused changes in ancient populations that led to their chosen organism and how further changes led to their organism going extinct, as other organisms had greater advantages. Students are both formally and informally assessed on the role of the environment in bringing about change in the proportion of a species across generations.

Lesson Title(s)	Lesson Description(s)
Environmental and Physical Factors Impact Traits in Populations	In the lesson, " Environmental and Physical Factors Impact Traits in Populations", students explore resources and information about the deer mouse at a variety of ecological levels to better understand the factors that impact the genetics of a deer mouse. Utilizing resources from Lesson 1.2 of Deer Mouse Fur Color, students learn the basics about the deer mouse and its environment and observe the impact of predators on mice in different environments.
	What Students Figure Out
	a. Natural selection, which over generations leads to adaptations, is one important process through which species change over time in response to changes in environmental conditions (CCC: Cause and Effect).
	b. Mathematical representations can be used to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time (SEP: Using Mathematics and Computational Thinking).

Formal Assessment Title	Assessment Description
Environmental and Physical Factors Impact Traits in Populations	In this assessment, students analyze data to examine how environmental conditions impact traits displayed in a population. Students are presented with one or more studies that provide a real-world/citizen science data set for students to analyze. Students conduct a comparative analysis of the data sets to find patterns related to how traits expressed in populations respond to different conditions.

NGSS PE(s) Code(s) & Description(s)

MS-LS4-6. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

AG(s) Code(s) & Description(s)

A15. Develop and/or use a model that shows the relationships between genes, mutations, proteins, structures, and functions.

A16. Determine similarities and differences using patterns in findings related to the proportions of a species in a population across generations.

A17. Use mathematical representations to support scientific conclusions about how environmental conditions caused species to change over time.

A19. Construct an explanation about how a species' survival rate is due to the presence of an advantageous trait.

Evidence Statement(s)

- Generate mathematical representations of the relationship between environmental conditions and changes in traits of species over time.

- Describe how mathematical representations support conclusions about how environmental conditions caused species to change over time.

- Accurately identify patterns related to the proportions of a species with a particular trait or traits across generations.

- Construct an accurate explanation that describes how an advantageous trait in a population led to an increase in the population of a species.

Phenomenon or Phenomenon-rooted Design Problem

- Snowshoe hares and other organisms have a camouflage adaptation that helps protect them against predators. Depending on the season, the hares' fur can be a different color. During the winter, snowshoe hares are white, which helps them blend in with the snow. When the seasons change to spring and summer, snowshoe hares turn reddish-brown. This color helps them camouflage with dirt and rocks.

General Scenario Description

Students will be introduced to a list of present-day organisms and adaptations they have that make them successful in their environments (this may occur at the beginning of Instructional Segment 1 or 2 before this point). Students are given a scenario that asks them to consider which snowshoe hare would be more vulnerable to predators. Students will be asked what they predict would happen to the snowshoe hare population if climate change created a warmer environment. Students analyze a data table to produce a graph representing the changes in the populations of two different variations of peppered moths over time. Students analyze the data and answer questions about how environmental conditions caused the observed changes in the two moths' population sizes during the given time period.

Chain of Sensemaking

- Students observe snowshoe hares in two seasons.
- Students identify which hare would be more vulnerable to predators.
- Students read an article and/or watch a video about snowshoe hare adaptations.
- Students predict what would happen to the snowshoe hare population in response to the effects of climate change.
- Students will analyze a data table and/or graph about population changes in peppered-moth populations over time.
- Students will use the data to explain why the environmental conditions caused the species to change over time.

Work Products

- Short response
- Graph

Application of Universal Design for Learning-based Guidelines to Promote Accessibility (https://udlguidelines.cast.org/)

Multiple Means of Engagement	Multiple Means of Representation	Multiple Means of Action & Expression
☒ Context or content	☒ Provide visual diagrams and charts	☒ Solve problems using a variety of strategies
☒ Age appropriate	☒ Make explicit links between information	☐ Sentence starters
☒ Appropriate for different groups	provided in texts and any accompanying	☒ Embed prompts to "show and explain your

☒ Makes sense of complex ideas in creative ways	representation of that information in illustrations, equations, charts, or diagrams	work"
☒ Vary the degree of challenge or complexity within prompts	☐ Activate relevant prior knowledge	
	☐ Bridge concepts with relevant and simple analogies and limited use of metaphors	
	☒ Highlight or emphasize key elements in text, graphics, diagrams, formulas	
	☒ Use outlines, graphic organizers, unit organizer routines, concept organizer routines, and concept mastery routines to emphasize key ideas and relationships	
	☐ Give explicit prompts for each step in a sequential process	

Targeted PE(s) Code(s) and Alternate Conception(s)

- **NGSS PE: MS-LS4-6.** Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]
  - o **Common Alternate Conceptions**
    - ▪ Organisms can change their features to suit their environment.
    - ▪ Animals of the same species all have the same features.
    - ▪ Natural selection occurs within an organism's lifetime.
    - ▪ "Survival of the fittest" means the strongest individuals survive.
    - ▪ Natural selection is goal-oriented.

Unit 1 Vocabulary

- Evolution
- Trait
- Natural Selection

- Adaptation
- Species
- Camouflage